Hiatal Hernia: Update and Technical Aspects

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Introduction

Hiatal hernia is defined as the herniation of the stomach, possibly with other abdominal cavity elements, through the esophageal hiatus of the diaphragm. The most used classification describes four types of hernia: type I is the sliding hiatus hernia; type II the rolling hernia, where the gastric fundus herniate, while the gastroesophageal junction remains in the abdomen; type III the mixed hernia: with elements of both types I and II hernias; type IV is characterized by the presence of organs other than the stomach in the hernia sac. Types II–IV hernias as a group are referred to as paraesophageal hernias. Type I is the most common (95% of the cases), followed by type III, which comprises almost all paraesophageal hernias. Type II and IV are rare. Gastric volvulus is commonly associated with paraesophageal hiatal hernias. During sac reduction, the content is also retracted into the abdomen and the volvulus is automatically derotated. Natural history of hiatal hernias is not really known, but preliminary studies suggest that, like all other types of hernia, they tend to increase in size over time [1]. The anatomic disruption of the gastroesophageal junction, due to hiatal hernia, leads to the disruption of natural anti-reflux mechanisms and hernia size is one of the main determinant of reflux severity [2]. Indeed, symptoms of hiatal hernia can be distinguished into GERD-related and Non-GERD-related. GERD symptoms are described in another chapter. Non-GERD symptoms include all those related to compression of mediastinal structures and to damage of herniated organs. A particular case is that of asymptomatic paraesophageal hernias. In those patients, prophylactic paraesophageal hernia repair is debated among experts. Although there is no consensus, most would agree that very old or debilitated patients should not undergo surgery, while younger and healthier patients, with a life expectancy of at least 10 years, should consider surgery to prevent both the risk of acute complications and potentially progressive symptoms [3].

We here describe hiatal hernia repair associated with floppy Nissen fundoplication. This procedure appears to be the most effective one and is considered the gold standard [4, 5] but it is also associated with nonnegligible potential for dysphagia and gas bloat syndrome. Adding a fundoplication after crural repair is strongly suggested by experts to stabilize the repair and reduce postoperative GERD; however, this step is not considered strictly necessary in the literature. The use of meshes is debated, but it can be useful, if not even necessary, in some cases of difficult direct repair. Both absorbable and nonabsorbable meshes have been used. We prefer absorbable meshes, which disappear and create a scaffold for tissue repair, reduc-

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ing if not eliminating the risk of esophageal erosion. This dreaded complication has been instead reported for nonabsorbable meshes.

Moreover, the pressure gradient across the abdominal and thoracic cavities predisposes the patient to recurrence. The clinical recurrence rate is much lower than radiographic recurrence (assessed by a barium esophagram). Most patients with radiographic recurrence after repair are asymptomatic. Only a small fraction of patients will require a re-repair for complications or intractable symptoms (around 15% of patients). Since complications are not negligible, meticulous selection of patients, good indications, and careful application of surgical principles and techniques are mandatory to increase the chance of successful results. In this chapter, we will mainly focus on indications for surgery and surgical steps, since we strongly believe that these are the keys for a successful operation.

Indications

GERD-Related Esophageal Indications

- Failed optimal medical management (persistent symptoms on PPI).
- Noncompliance (unwillingness or intolerance/side effects) with chronic medical therapy.
- High volume/severe regurgitation (liquid or solid) and regurgitation as main complaint.
- Nonacid reflux.
- Severe esophagitis by endoscopy (Los Angeles C & D) and stricture.
- Barrett's columnar-lined epithelium (short Barrett & without severe dysplasia or carcinoma).

GERD-Related Extra-esophageal Indications (If Condition Is Surely Related to Reflux)

- hoarseness.
- cough.
- globus (lump sensation in the throat).
- laryngitis and laryngospasm.
- asthma.
- recurrent aspiration pneumonia.
- cardiac conduction defects.
- dental erosions and gingivitis.
- symptomatic or complicated paraesophageal hernia.

Non-GERD Indications

- Emergency repair: acute gastric volvulus, uncontrolled bleeding, obstruction, strangulation, perforation, or respiratory compromise secondary to a paraesophageal hernia.
- Elective repair: subacute symptoms, like respiratory complications from mechanical compression of the lungs (post-prandial chest fullness, shortness of breath), dysphagia, post-prandial thoracic pain, anemia or chronic bleeding, cardiac problems from compression of the heart.
- Prophylactic repair in asymptomatic patients: suggested in fit patients.

Contraindications

- Unstable or incurable preexisting comorbidities.
- Unable to tolerate general anesthesia.
- Morbidly obese patients (BMI >40 kg/m^2) (relative, consider bariatric surgery).
- Advanced age (relative).
- Coagulopathy (relative).
- Previous extensive abdominal surgery (relative).

Preoperative Workup

- EGD (to detect esophagitis, hiatal hernia, Barrett's esophagus, or neoplastic lesions).
- 24 hours pH-impedence test (only in case of GERD symptoms)
- Barium swallow (to measure the size of hiatal hernia, to describe if hernia is stable or intermittent, to detect and describe the degree of regurgitation of contrast medium).

- Manometry (to rule out dismotility, like achalasia).
- CT scan (to study the anatomy of esophago-gastric junction-EGJ region and rule out extrinsic compression of the esophagus and EGJ).

Laparoscopic Instrumentations

- Laparoscopic gauzes and epinephrine (water-diluted epinephrine-soaked gauzes can help stop minimal bleeding).
- Veress needle.
- Three 10–12 mm trocars and two 5 mm trocars.
- Bipolar laparoscopic forceps.
- Energy device: ultrasonic or radiofrequency dissector.
- Laparoscopic curved scissor.
- Laparoscopic needle holder.
- 2/0 or 0 nonabsorbable braided suture.
- Endoscopic liver retractor and table-mounted retractor holder.
- Endoclip applier.
- Atraumatic graspers.
- Cotton surgical tape or Penrose drain.
- Suction/irrigation device.
- Mesh (absorbable or nonabsorbable).

Patient Setup and Position

– Standard supine position.
– Split legs "French Position" (suggested, but optional) or Standard Supine "American Position."
– Reverse Trendelenburg position.
– Surgeon between patient's legs or on the patient's left side.

Trocars Placement (Fig.1)

– Port A (10 mm): camera port. Initial access is gained with an open or closed technique approximately 12–14 cm from the xiphoid process, slightly on the left side of the patient. The distance from midline increases in patients with higher BMI.
– Port B (10 mm): surgeon's right-hand working port. Placed on the midclavicular line on the left side of the patient, immediately below the costal margin.
– Port C (5 mm): surgeon's left-hand working port. Below the xiphoid process, slightly higher than port B to better access the mediastinum. It is preferable to place this port immediately left to the falciform ligament to avoid interference during instrument exchanges.
– Port D (5 mm): first assistant port, placed just below the left costal margin.
– Port E (5–12 mm): liver retractor port, placed below the right costal margin.

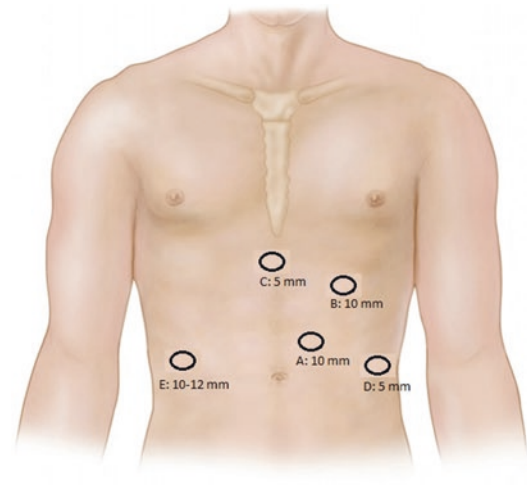

Fig. 1 Port placement

Surgical Technique

There are several controversies in the surgical repair of a hiatal hernia but some steps are still critical for a successful outcome [3].

Essential Steps

Dissection of hiatus and sac excision.
Mobilization of esophagus.
Mobilization of gastric fundus and short gastric vessel division.

Crural closure with or without mesh reinforcement.
Floppy Nissen fundoplication.
Control endoscopy (optional).

Description of the Technique

Dissection of Hiatus and Sac Excision

- After trocars placement, abdominal exploration is carried out and liver is retracted, exposing the hiatus (Fig. 2).
- The procedure starts with the division of the pars flaccida and condensa of lesser omentum, possibly preserving the left vagal branch of the anterior vagus, with right crus identification.
- Then, the right crus is dissected starting at the 11 o'clock position, bluntly entering the mediastinum. A gentle reduction of the hernia contents is initially attempted, but only for the part that can be easily reduced: the critical step is to reduce the entire sac into the abdomen, which will bring together the content. Sac dissection facilitates reduction of the hernia, protects the esophagus from iatrogenic damage, and decreases early recurrence.
- The sac dissection is bluntly carried out with the assistant grasping the sac margin and pulling it downwards. It is important to completely dissect and reduce the sac into the abdomen, possibly without tearing it. The dissection will need to go down to the decussation of the crural fibers of the left crus. The peritoneal coverage of the crus should be preserved to provide some support at the time of crural closure.
- Care should be taken to identify and preserve the anterior and posterior vagus nerves, remembering that the anterior one traverses along the anterior esophagus from the left of the patient, while the posterior one comes from the right.
- When the sac and its contents are successfully reduced, a retroesophageal passage is created and a cotton surgical tape or Penrose drain is placed around the esophagus, to provide atraumatic retraction by the first assistant for safe esophageal dissection (Fig. 3).

Mobilization of Esophagus

- Retracting the surgical tape inferiorly, dissection around the esophagus is carried out. Since it is a mainly an avascular plane, blunt dissection should be preferred as much as possible, with the exception of a few esophageal aortic branches that need division with the energy device.
- The esophagus should be freed and mobilized extensively up to the inferior pulmonary veins. It is important to gain at least 3 cm of intra-abdominal esophagus, which should be mobile and should remain in the abdomen without tension.
- Important structures surround the esophagus in the mediastinum, care should be taken to identify and preserve both vagus nerves and avoid injury of pleura, pericardium, inferior pulmonary veins, and aorta. Injury of the pleura during mediastinal dissection is fre-

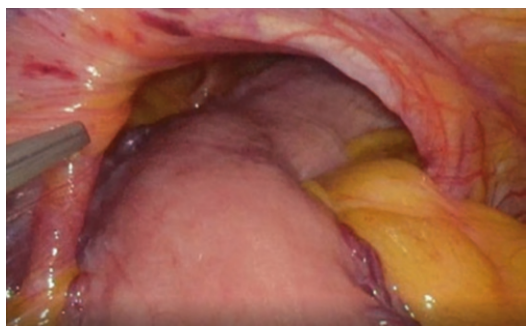

Fig. 2 Large Hiatal Hernia at diagnostic laparoscopy

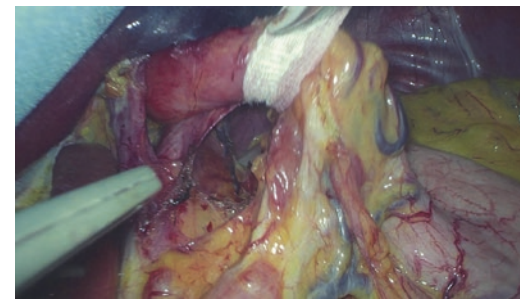

Fig. 3 A Retro-esophageal window is created to facilitate dissection and mobilization of the lower esophagus

quent in big hernias, nevertheless it does not require to be repaired to avoid causing tension pneumothorax. At the end of the procedure, the Valsalva maneuver at extubation will evacuate CO_2. Rarely, in case of severe respiratory distress, a chest drain can be placed.

Mobilization of Gastric Fundus and Short Gastric Vessels Division

- When the esophagus is well mobilized, the gastric fundus mobilization begins. The key to successful floppy Nissen consists in the division of the short gastric vessels necessary for the fundoplication, avoiding excessive gastrolysis on the greater curvature, which might be involved in "gas bloat syndrome."
- The first assistant grasps the apex of the gastrosplenic ligament and the surgeon the anterior wall of the stomach for countertraction. Then the lesser sac is entered approximately above the lower limit of the spleen, used as a caudal landmark. The dissection proceeds upwards close to the gastric wall, avoiding inadvertent thermal injuries to the stomach, up to the left crus (Fig. 4).
- The fundus must be freed completely on the posterior wall, dividing all short gastric vessels. High Frequency bipolar or ultrasonic dissectors normally provide good hemostasis without the need for clipping.
- Mobilization of the gastric fundus ends the first part of the procedure. Correct mobilization of esophagus and gastric fundus is mandatory to obtain an adequate retroesophageal window for a floppy Nissen.

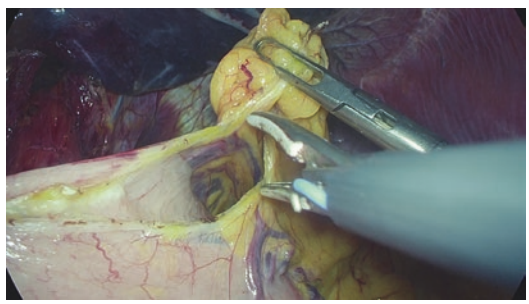

Fig. 4 Gastric Fundus mobilization along the greater curvature

Crural Closure with or Without Mesh Reinforcement

- The crus should be closed posteriorly, with possible addition of anterior closure in case of wide hiatus.
- The crus should be repaired with 0 or 2/0 braided nonabsorbable sutures. Normally a direct closure is sufficient to repair the defect. Nevertheless, in case of a huge hiatal defect (normally more than 5 cm) or weak and fragile crural muscles, a mesh can be placed onlay after direct repair. "Figure of 8" sutures or simple interrupted sutures are the best options for crural repair (Fig. 5). Both absorbable and nonabsorbable meshes have been used. We prefer absorbable meshes, which disappear and create a scaffold for tissue repair, reducing if not eliminating the risk of esophageal erosion (Fig. 6). This dreaded complication has been instead reported for nonabsorbable meshes. The mesh is fixed laterally to the pillars with single stitches or absorbable tacks, avoiding to place tacks on the anterior and

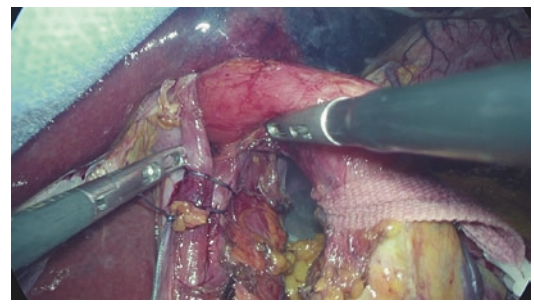

Fig. 5 Crural Closure using breaded nonabsorbable suture

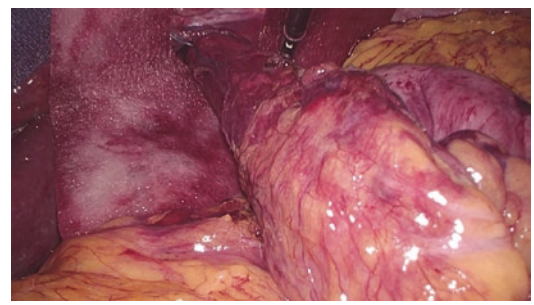

Fig. 6 Mesh used for crural reinforcement (optional)

posterior hiatus, for the high risk of damage to pericardium and aorta, respectively.
– The crural closure should neither strangulate nor shred the muscle.
– Once the hiatus is repaired, the esophagus should comfortably occupy the defect, without being angulated or compressed. The closure should permit easy passage of a 5 mm-tip instrument.

Floppy Nissen Fundoplication

– The last step of the procedure consists of the construction of a floppy fundoplication. This is 360° fundoplication positioned around the distal esophagus and esophagogastric junction (at the level of the Z line). It must be short (2 cm long) and tension-free.
– The reduced sac should be excised in order to have a more clean gastric wall to properly perform a correct fundoplication.
– The stomach is replaced in anatomical position and the assistant retracts the esophagus with the surgical cotton tape to expose the retroesophageal window and the posterior wall of the stomach.
– The surgeon brings the posterior fundus through the retroesophageal window. Then the so-called *shoeshine maneuver* is used to confirm that the fundus remains comfortably in position and is not retracted to the left of the patient (Fig. 7).
– The fundoplication is created with 2 or 3 interrupted nonabsorbable braided sutures (0 or 2/0). One or more sutures can incorporate the anterior esophageal wall. Nonetheless, we prefer to avoid including the esophagus, obtaining a more floppy wrap, and avoid damaging the anterior vagus nerve (Fig. 8). We prefer fixing the fundoplication with a lateral suture from the inferior left border of the wrap to the anterolateral esophageal wall at the level of the dissected phrenoesophageal membrane, in order to avoid telescoping or slippage of the wrap (Fig. 9). Other sutures can be added on the right side or cranially above the fundoplication if needed. Posterior or anterior gastropexy sutures can be further added.
– Intraoperative control endoscopy can be performed to confirm correct position and patency of the fundoplication and absence of twisting.
– No drain is normally necessary. The trocars are removed and the incisions are closed in standard fashion.

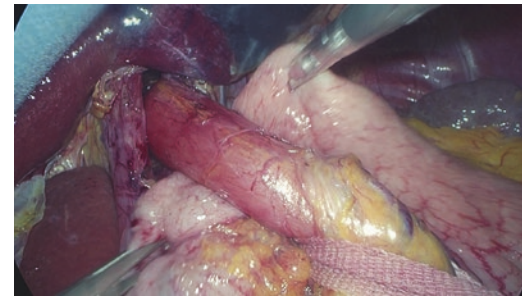

Fig. 7 The so-called *shoeshine maneuver* to confirm that the fundus is sliding loose around the esophagus

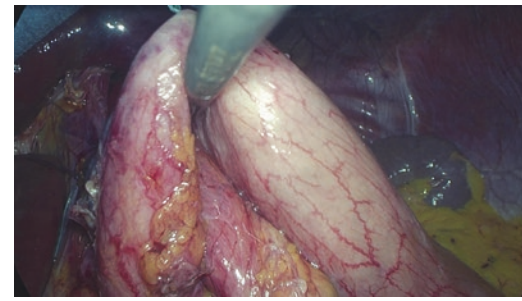

Fig. 8 A floppy fundoplication is made

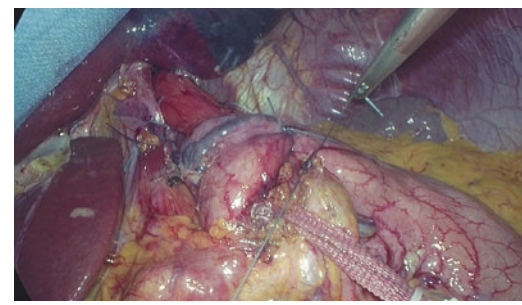

Fig. 9 To avoid slippage, additional suture may be useful to fix the wrap inferiorly

Postoperative Care and Follow-Up

- Upper GI Gastrografin study [1] on the first postoperative day is possible but not mandatory.
- Clear liquids are allowed on the first postoperative day (POD1).
- Soft mashed diet is started on POD2 and it is suggested until POD7.
- Soft fractionated diet is started on POD8 and suggested for 4–8 weeks, followed by return to regular diet.
- Postoperative dysphagia and delayed gastric emptying are common, but patients should be instructed that these symptoms are typically self-limiting and should disappear approximately 2 months after surgery.
- Antiemetics are given at scheduled times for the first 24 h, to avoid early retching and early recurrence, and then on demand.
- PPI are normally used in the first 15–30 days and then suspended.
- Discharged with prescription for antiemetics.
- Follow-up at 1 week with clinical evaluation, then at 1 month with a barium swallow study. We normally suggest further clinical evaluation at 6 months after surgery and then on demand.

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